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RESEARCH PAPER

How to foster good husbandry of private native forests

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Abstract It is generally agreed that effective conservation requires the cooperation of private landholders to complement reserve-based efforts, but there is little agreement about how this can best be achieved. Various stakeholders lobby for tough regulations, for greater landholder freedom, and for incentives for activities or outcomes. A review of these alternatives suggests an emerging consensus that incentives are the most effective approach. Policy-makers should consider incentive-based approaches such as stewardship support to foster conservation outcomes on private lands.

Keywords Private native forestry · Payments for environmental services · Duty of care · Stewardship

Introduction

In Australia, the New South Wales (NSW) State Government has been attempting to introduce regulations restricting management activities on private native forests for several years (Nichols 2007). The government approach relies largely on regulation to enforce particular behaviour patterns, despite public support for the use of incentives (Vanclay 2007). This paper examines the likely efficacy of a regulatory approach and considers alternatives, drawing on experience and evidence from Australia and abroad, and seeks to offer insights that may lead to more effective ways to foster good land husbandry on private land. The paper does not attempt to offer a comprehensive review of the vast and rapidly-growing literature on payments for environmental services (surveyed for example in Pagiola et al. 2002 and Wunder 2005). Instead, attention is confined to material that is directly pertinent to issues influencing the management of private native forests in NSW.

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This review begins with a brief overview of the threats to, and opportunities for the provision of environmental services (especially biodiversity conservation) in private native forests. The review then proceeds as a binary key, examining a series of alternative options, beginning with generic aspects of environmental services, progressively dealing with issues that are more specific to the husbandry of private native forests, and leading to a recommendation regarding the best way to foster good husbandry of these forests.

Threats and Opportunities in the Provision of Environmental Services

In any analysis of instruments to influence land husbandry, it is prudent to begin by briefly examining the major threats to the system, and by considering the opportunities that exist to mitigate these threats. The draft NSW (2003) private native forest legislation is clearly aimed at timber harvesting, but treats broadscale clearing of extensive areas (i.e., deforestation), selective harvesting of individual trees, and other silvicultural activities (e.g. timber stand improvement) equally, even though the scale and consequences of these operations are very different. Few researchers or stakeholders regard timber production as a serious threat to native forest biodiversity. The 30 key threatening processes listed in Schedule 3 of the *Threatened Species Conservation Act*, *NSW* (1995) do not include timber harvesting or related activities, and are largely concerned with exotic species. Generally, invasive alien species are considered to be the major threat to biodiversity (Wittenberg and Cock 2001), and domestic herbivores have been shown to be a major threat to Australian marsupials (Lunney 2001; Fisher et al. 2003). The *Action Plan for Australian Birds* (Garnett and Crowley 2000) identified land clearance (affecting 113 of 261 extinct, threatened and near threatened birds) and introduced predators (affecting 95 species) as the principal threats. Timber harvesting was well down on their list, with selective timber harvesting and clearfelling currently affecting 18 and 8 species respectively (Table 1). These totals are diluted by non-forest habitats, but similar trends emerge within specific forest habitats: land clearance currently threatens 6 of 9 threatened bird species in temperate forests (cf. 3 for selective logging), and 23 of 24 species in temperate woodlands (cf. 10 for selective logging, and 16 for domestic herbivores). The major threats to birds in tropical and sub-tropical woodlands are domestic herbivores (11 of 15 species) and inappropriate fire regimes (11 species). This assessment of threats begs the question why the private native forest legislation devotes so much attention to regulating forestry, and why it attempts to couple timber production with land clearing!

Threats to other fauna and flora are not so clearly articulated, but a consistent thread emerges: forest management for timber production is not the greatest threat to forest-dependent species. A similar view was reflected in a recent survey (Vanclay 2007) in which the most common response regarding the major threat to private native forests was weeds and feral animals (28%, cf. 12% considered logging a threat).

The introduction of a Code of Practice for Private Native Forestry (DNR 2006) could offer a mechanism to improve the standard of management private native

Table 1 Extract from the *Action Plan for Australian Birds* (Garnett and Crowley 2000) showing the current top 12 threats to forest and woodland birds

Habitat	Temperate woodland	Tropical and Sub-tropical woodland	Rainforest	Temperate forest	Total
Land clearance	23	3	5	6	60
Domestic herbivores	16	11	2	1	65
Feral herbivores	15			1	36
Firewood collection	15			1	21
Selective logging	10	1	3	2	18
Native herbivores	10				15
Inappropriate fire	7	11	7	1	47
Development	6		2	3	16
Native competitors	4			3	11
Introduced predators	3	1	2		44
Clearfelling	2	1		3	8
Total taxa	24	15	13	9	236

forests in NSW, especially if accompanied by appropriate extension activity, but, as the centrepiece to the *Native Vegetation Act*, could be counterproductive in diverting attention from greater threats such as management of fire, grazing and feral animals. Private native forests present unique opportunities to manage for biodiversity. In a recent review, Stephens (2001) observed that the majority of strategies and plans for biodiversity conservation have a message that 'is straightforward and consistent:

- formal conservation reserves alone cannot conserve the full complement of Australia's biodiversity and ecological systems;
- conservation must occur across the landscape, regardless of tenure;
- participation of private landholders is critical, as they manage about two-thirds of the continent's land-mass; …' (Stephens 2001).

Private lands offer opportunities for active biodiversity management that are often difficult to implement on public lands. National parks are ideal for the conservation of species reliant on late stages of ecological succession, but are less able to cater for species that require disturbance (e.g. the threatened and still-undescribed McIvor River *Macarthuria* from north Queensland, Clarkson 2000). Garnett and Crowley (2000) highlighted the dependence of some threatened species on appropriate fire regimes difficult to achieve in national parks, which have a tendency to burn infrequently and completely. Private land also offers greater flexibility for control of weeds and feral predators. The UNESCO MAB Biosphere Reserve model (Dyer and

Holland 1991; Matysek et al. 2006) specifically recognises this, and advocates concentric bands of managed native vegetation surrounding a core of strict conservation areas, offering a model that integrates national parks and managed private land in conservation objectives.

There is great potential for private land to be managed for multiple uses including biodiversity outcomes, to complement the more passive conservation role provided by national parks in Australia. The challenge is to find efficient ways to realize this potential.

What Counts in Conservation: Place or Process?

The opportunities to manage private for conservation leads to an important question: is the physical location, or the ecological niche more important in the management of land for environmental outcomes? Obviously, location pre-ordains some outcomes (i.e., it is illogical to manage for penguins in the tropics), but for many species, the provision and maintenance of a suitable niche is critical (e.g. *Macarthuria*). In Europe, there is general recognition of the need to manage for conservation outcomes (e.g. Sheail et al. 1997), but the dominant conservation paradigm in Australia has been to use land tenure (e.g. national park and other crown reserves, conservation covenants) to protect particular places for their conservation significance, and to place less emphasis on the processes that have shaped these places (Smith et al. 1993; McNeely 1994). This is appropriate for habitats that develop late in an ecological succession, but may not serve the intended purpose if a target species requires disturbance. In modern environments, where native vegetation has become fragmented and where many renewal processes (such as fire and flood) are regulated and modified, it is difficult to provide adequately for species that require disturbance (Saunders et al. 1991)—such as seasonal inundation (e.g. Jasper (2004) who reported on extraordinary regeneration following a flooding of ‘ordinary’ land), fresh sandbanks formed by floods, or fire to regenerate or rejuvenate—especially in a national park context. Unless managed, disturbance in fragments tends to be ‘all or nothing’, and may not naturally create the mosaic required by many species. Private land offers the flexibility to manage processes for conservation outcomes, and can complement national parks that provide for ‘place-oriented’ conservation.

It is easy to plan to manage special places for special outcomes, but there is an important corollary: sometimes natural events conspire to make ‘ordinary’ places special. For instance, some inland lakes and rivers may contain water infrequently; when filled they may be of immense conservation importance, but during the intervening dry years their conservation role may be minor and some farming practices may pose no threat. Woodland examples are less conspicuous, but flooding or fire that initiates a regeneration event, or extreme weather that initiates mass flowering may signal a period of particular conservation significance. Such events may occur sporadically across the country, and cannot be accommodated well within the traditional place-oriented conservation paradigm. Effective biodiversity management requires recognition that otherwise ‘ordinary’ land may have special

significance at particular times, and requires systems that encourage and reward sensitive management of that land at such times.

It is important to recognise that some conservation objectives are best served by national parks, and that others may be best served by encouraging land-use patterns on private land that are sensitive of biodiversity needs at different times and in different places. Such biodiversity-friendly land husbandry need not necessarily involve minimal intervention, but should focus on the processes that matter to the target species at that particular time.

What Counts in Conservation: Nature or Nurture?

Are conservation outcomes best achieved by allowing nature to run its course, or by nurturing particular processes? It is common to assume that 'mother nature' will take care of biodiversity matters, and that 'fence and forget' will provide desirable outcomes in national parks. This may be so in some remote national parks, but in many locations, weeds, feral predators and competitors, altered fire regimes (deliberate fires and suppression of natural fires), loss of connectivity of habitat and possibly climate change interfere with natural processes and limit the effectiveness of passive management in natural areas (Carey 2003). The most conspicuous aberration is fire: a post-fire mosaic of burned and unburned areas may be ideal for biodiversity outcomes, but is rarely achieved in national parks, many of which burn infrequently and completely (Agee 2002). Less conspicuous, but equally unnatural, are weeds and feral animals which may compete with or prey upon rare native species. European settlement, coupled with its entourage of exotic plants, animals and farming systems, has severely curtailed the ability of 'mother nature' to provide for all the species that existed at the time of settlement. Given this disturbance history, nature cannot ensure the survival of some species, which need to be nurtured in order to survive. Such nurturing may take the form of fire control and prescribed burning, the control of weeds and feral animals, and in some circumstances, culling of some individuals (e.g., Koalas on Kangaroo Island; Lindenmayer and Burgman 2005).

In Australia, John Wamsley has been a passionate advocate of the need to nurture threatened species, and his former ASX-listed company Earth Sanctuaries was an attempt to create habitats suitable for threatened fauna and free of exotic predators (Aretino et al. 2001). Earth Sanctuaries was successful ecologically in demonstrating an increase in the population of several threatened species, but did not succeed financially. Wamsley's passion was for marsupials threatened by feral predators, but similar needs arise with other species and processes. For instance, hydroelectricity and irrigation have appropriated much of the water in the Murray-Darling system, changing the river system towards regulated channels and dusty stream beds, and depriving red gum forest ecosystems of the periodic inundations on which they depend (Kingsford 2000). The well-being of many floodplain ecosystems depends on deliberate decisions to inundate the floodplain. There are many other examples of the need to nurture biodiversity at both the small- and large scale. The challenge is to encourage all landholders—not just public agencies—to

recognise and seize opportunities to bring about desired biodiversity outcomes by creating favourable conditions for selected species as part of their normal farming practices. A related challenge is the need to find a way to make such endeavours financially viable.

Is Conservation on Private Land a Duty or a Service?

As noted by Stephens (2001), most stakeholders are united in their view that private landholders are integral to biodiversity management, but views about obligations are more diverse: do landholders have a 'duty of care' to provide for biodiversity on private land, or are they providing an environmental service for which society should pay? Binning and Young (1997) argued that sustainable land management is a duty of care and that associated costs should be regarded as normal costs of production. However, this requires that landholder responsibilities are clearly articulated, a challenge which poses some difficulty. Bates (2001) countered that duty of care focuses attention on the penalties of a breach, rather than on desired environmental outcomes. His view is that a statutory duty of care would need to be supported by complementary approaches, including encouragement of voluntary action, education and financial incentives. Stoneham (2003) offered the view that duty of care is a blunt instrument that fails to utilize landholder diversity to create value. Hone and Fraser (2004) showed that duty of care is an inefficient way to deal with off-farm environmental costs, and argued that the economic issues of what is needed and who should provide it, should not be linked to the subjective question of who should pay. The emerging consensus seems to be that the duty of care concept may be useful as a minimum standard, but imposing a duty of care requirement is not an effective way to foster better land husbandry and improve biodiversity outcomes. It is irrelevant whether environmental services are a duty of care or a service to society; the relevant question is whether incentives or regulations are more effective in delivering the desired outcome.

Are Incentives or Restrictions More Effective in Fostering Conservation?

Pannell (2007) offered a rigorous framework for comparing the utility of positive and negative incentives and argued that positive incentives should only be offered when it was necessary to defray a net cost to private landholders which would be exceeded by the public net benefit thus gained. Most landholders cherish their native forest (Deane et al. 2003; Moore and Renton 2002), so it would seem logical that encouragement may be more effective than harassment. However, many environmental groups favour a regulatory approach to biodiversity conservation, believing them to be simple, effective and easy to implement (Khanna 2001; Wu and Babcock 1999). The regulatory approach may also appeal to government, as it offers a cheap and quick way to create the impression of progress with a challenging issue. Caution is required however, because regulations can be difficult to enforce and may be counterproductive (Banks 2003).

For some decades, the state of Oregon in the USA had regulations requiring logging operations to remove woody debris from streams, whether or not the debris was natural or logging residue. In the 1980s, ecologists realized that this debris was important to the stream ecology, so Oregon authorities did a complete about-face, and now require logging operators to inspect streams, and if indicated, deposit additional debris into streams (Bragg and Kirshner 1999). One way or another, Oregon had the wrong prescription state-wide, for at least 20 years. It would have been better not to prescribe, but to require monitoring of stream condition (e.g. temperature and turbidity), and reporting and amelioration of any changes. Clearly, a poor prescription is worse than no prescription.

Restrictive legislation may hamper recognition and management of threatened species and special events such as pulses of regeneration (e.g. Jasper 2004). For instance, under the proposed Code of Practice (DNR 2006), a sighting of a Powerful Owl (*Ninox strenua*, or of three other species of forest owl), if reported, would trigger a government requirement for a 50 m exclusion zone and a 1000 m buffer zone (with additional restrictions on land use in these 300 ha) about the roost tree. In the absence of incentives, how many landholders would report an owl sighting and initiate these restrictions, on their own land use and that of their neighbours? The result is that many landholders remain silent about the presence of threatened species on their land. They may well treasure these species and modify their land use practices to favour them, but they do not report a sighting because they wish to avoid the bureaucratic and restrictive regulations.

Even when a prescription is ‘correct’ for a particular species at a given time and place, it is difficult to enshrine continuing good husbandry. Stoneham et al. (2000) have emphasised that although legislative approaches have been successful in reducing land clearing, they do not address the need for continued management of the vegetation remnants. Several authors have argued for the use of incentives in conjunction with, or instead of regulations (e.g. ANZECC 2001; Emerton 1999; Hahn and Stavins 1992; Hutton and Leader-Williams 2003; NVRIG 2003, Stephens 2001; Robinson and Ryan 2002; Zhang and Flick 2001). Such an approach is likely to receive public support, because regulations are generally not popular amongst landholders or the broader public (Bacchi 2003; Schaaf and Broussard 2006; Vanclay 2007). The Australian Productivity Commission (2001) has called for the removal of legislative and regulatory constraints on private sector conservation, and for the establishment of incentives for private sector provision of environmental services enjoyed by the community. Goldstein et al. (2006) examined such an approach in Hawaii, and suggested that combining timber harvesting and environmental service payments could advance conservation objectives.

As a signatory to the Convention on Biological Diversity, Australia would appear to have an obligation to provide incentives under Article 11 of the convention, which states that, ‘each Contracting Party shall, as far as possible and as appropriate, adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity’ (McNeely 2006, p. 1).

Who Should Pay for Incentives?

'User pays' is a popular political mantra, but it is not always easy to define the users of environmental services provided by private native forests. Some services are spatially confined (e.g. hydrological benefits), others are global (e.g. carbon sequestration), while demand for—and benefits of—biodiversity services may accrue at scales ranging from local to global. Some local governments exempt land devoted to biodiversity conservation projects from rates and other local taxes (Binning and Young 1999), but there is relatively little support for private multiple-use initiatives at the state level in NSW.

Sinden (2003) found that the cost of protecting native vegetation amounted to 16% of the household income of farm households in Moree Plains Shire, whereas urban households in Australia paid less than 1% of their income through taxes for the same purpose. In other words, the unequal cost burden falls most heavily on farmers, who are already struggling financially. Amongst farmers, the burden falls most heavily on those who have retained native vegetation, while those who have already cleared their native vegetation suffer no further impost. There are many advocates for a fairer distribution of the costs, most of whom observe that if conservation is recognized as a 'public good' of national importance, then the cost burden should be shared when it exceeds the landholder's duty of care responsibilities (Productivity Commission 2001; Stephens 2001). The Productivity Commission (2004) has proposed that the wider community should pay for the costs of providing 'public-good' environmental services, such as biodiversity conservation, on the grounds that this as the most efficient and effective in achieving desired environmental outcomes.

A study by Lockwood et al. (2000) revealed that costs are a major barrier to conservation management, and that substantial financial incentives are needed for landholders to undertake conservation activities. Their benefit-cost analyses indicated a net economic benefit sufficient for governments to spend $40.5 M in the Murray catchment and still achieve a net economic benefit (at 7% discount rate). Clearly, there is a strong case for developing funding arrangements that encourage sustained effort by landholders to maintain environmental services valued by the community (Allen Consulting Group 2005). Long time scales are often needed to achieve meaningful environment outcomes and this means an effective framework should allow for a stream of payments extending over 15 or more years, conditional on sustained landholder action.

Getting Value-for-money: Stewardship Payments or Competitive Tenders?

Borthwick (2005) has argued that biodiversity payments should be allocated on the greatest value for money, and thus should be allocated on a competitive basis, with all landholders able to contribute to the desired outcomes eligible to participate in the competition. Chaudhri (2003) pointed out that such competitions force policy-makers to be clear about objectives, but cautioned that it is easy to design 'bad auctions'. Stoneham (2003) observed that one difficulty with environmental markets

is that much information needed for meaningful transactions is hidden, increasing transaction costs because potential buyers and sellers of environmental services are poorly informed. Kluender et al. (1999) have suggested that the efficiency of auctions may be overestimated, because many owners apply only for those subsidies that support management practices which they were going to implement anyway.

A further limitation of auctions is the need for policy-makers to define objectives. Policy-makers in Oregon undoubtedly intended to improve fish habitat, but unwittingly caused more than a decade of habitat degradation. In Australia, policy-makers may offer subsidies to fence remnant native vegetation in the hope that this will assist wildlife, but these fences may be ineffective if predators rather than habitat are the limiting factor, and may be detrimental if weeds or fires degrade the habitat. Auction-based approaches focus on inputs (e.g. fences), whereas stewardship payments can reward a landholder for outcomes delivered (e.g. evidence of a threatened species on their land). Thus auctions require authorities to prescribe desired activities, whereas stewardship payments can minimize the risk of an 'Oregon debris debacle' by harnessing landholder knowledge and encouraging adaptive management. Stewardship payments may offer landholders a surplus above the minimum they were prepared to accept (cf. auction), but offer a fair and equal payment to all, and may offer efficiencies not present in an auction system (lower overheads, no payment for ineffective work).

Ferraro (2001) and Ferraro and Simpson (2002) argued that it is cost-effective to pay for ecosystem protection directly, and preferable to implement the best direct-payment approach, rather than a second-best policy option. Government payments for ecosystem services should relate specifically to the land stewardship practices undertaken, and could be made contingent upon verifiable environmental improvement, or demonstrable implementation of practical activities (Mech et al. 2003). Whitten et al. (2003) observed that subsidies and stewardship payments are amongst the most efficient incentives, and require little regulatory intervention. The Southern Cross Group also advocated stewardship payments (Vanclay et al. 2006), and suggested a simple way for such payments to be based on outcomes, such as the area of habitat suitable for, and occupied by threatened species.

Discussion

While there is evidence to support the general view that conservation on private land is essential to complement public efforts (national parks and other crown reserves), there is less evidence to shed light on the debate between conservation covenants versus multiple use, between duty of care versus incentives, and between auctions versus stewardship payments. Some case studies (e.g. Ferraro and Burnside 2001) offer useful insights, but do not help to resolve the broader debate. More comprehensive data may be ambiguous: for instance, an absence of prosecutions in a jurisdiction may indicate compliance with regulations or lax enforcement. Such difficulties are not confined to Australia, but also hamper evaluation of comparable issues elsewhere, for example in agri-environment schemes in Europe, as reported by Kleijn and Sutherland (2003).

In the absence of empirical data, it is tempting to weigh up the literature, but this too, may be ambiguous. A search with Google Scholar[1] suggests that 'stewardship' is more common than 'auction OR tender' in the academic literature on biodiversity conservation, but many of the references were common to both searches, and the prevalence of stewardship may simply indicate more discussion, not more support. Ultimately, obtaining reliable empirical data to discriminate between the various options may prove impossible, and it is likely that policy-makers will need to base their decisions on the quality of the arguments. Sadly, it is likely to be politically expedient to choose the regulatory route, in which it is easy to create the illusion of progress, at minimal expense. It is also unlikely to offer the best outcomes for conservation in private native forests. Continuing stewardship payments are likely to be the most effective way to stimulate management for conservation (and other environmental services) on private land.

How might continuing stewardship payments be funded? Since everyone benefits from better conservation outcomes, it is reasonable to expect broader society to contribute towards this end. This argument leads to the suggestion that stewardship payments should be funded from general taxation revenue. However, in Australia, income tax is a federal responsibility, and (apart from international treaties) conservation is a state matter. An alternative argument is to point out that in the past, all land was capable of providing some conservation outcomes, but now conservation is precluded from much land that has been developed for urban or industrial use. A duty of care viewpoint suggests that all landholders should contribute towards conservation, but some landholders are no longer able to do this directly because of development on or near their land. Generally, these are the same landholders who have benefited most from increases in land value. Those who have contributed least towards conservation (by developing their land rather than by retaining vegetation) have benefited most financially. One relatively fair way to finance incentives for conservation on private land could be through some form of land tax (on all land, including urban land), with the contribution from each landholder proportional to land value. This would recognise the concept of a duty of care by all landholders, and reward those landholders who fulfil that duty. NSW currently collects about $1750 M in land taxes (OSR 2006), so a relatively small levy could provide a substantial fund to finance stewardship payments.

How might stewardship payments be allocated to service providers? The Southern Cross Group advocated a two-tiered system of support, in which the first tier rewards and encourages landholders to regenerate more forest, and the second tier encourages stewardship of endangered species and ecological communities (Vanclay et al. 2006). The first tier could be provided through an annual payment based on standing basal area, a conventional and easy-to-measure forestry statistic representing the total cross-sectional area of living trees. This would offer a incentive to encourage more trees, to allow them to reach bigger sizes, and to invest in silviculture for faster tree growth. Although a relatively 'blunt' instrument, it is

[1] A search for 'stewardship' in conjunction with 'biodiversity-conservation private-forest OR private-native-forest' yielded 309 references, whereas 'auction OR tender' (and the same co-terms) yielded only 83 references (scholar.google.com, 2 March 07).

attractive because it is amenable to self-assessment, is easy to audit (through fieldwork or satellite imagery), and adjusts automatically for land quality (well-watered fertile land can grow higher basal areas than arid land). The second tier could involve a subsidy based on the contiguous area of suitable habitat, triggered only on an authenticated record of a species within that habitat. The simple expedient of allocating equal funding to each endangered species would adjust automatically for rarity, with the largest subsidies accruing to species that are rare or confined in their distribution. Basing the subsidy on habitat area avoids the need for expensive surveys, while an authenticated record retains an incentive to control predators. Restricting the subsidy to contiguous habitat encourages the creation of corridors and fosters collaborative management between adjacent landholders. This incentive creates an awareness of endangered species, and should overcome the current situation where many landholders regard the presence of a threatened species on their land as a liability likely to lead to restrictions on future farm enterprises.

Conclusions

Despite wide support for the view that the cooperation of private landholders is essential for effective biodiversity conservation, there is little agreement amongst researchers and managers about how this can be achieved. Environmental NGOs lobby for tough regulations, farmers' groups call for greater freedom in land management, and many researchers advocate incentives. There are few empirical studies documenting the efficacy of these alternative approaches, but there does appear to be a consensus emerging amongst researchers (if not amongst environmental NGOs) that incentives are likely to be the most effective, equitable, and ultimately the most efficient, approach (Shogren 2005). Policy-makers in Australia (and elsewhere) should consider incentive-based approaches to achieve conservation outcomes on private lands.

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References

Agee JK (2002) The fallacy of passive management: managing for firesafe forest reserves. Conserv Pract 3(1):18–26

Allen Consulting Group (2005) Financing long term conservation action options for outsourcing asset management and disbursement. November 2005. Report to the Commonwealth Department of the Environment and Heritage, Canberra, 68 pp

ANZECC (2001) Biodiversity conservation research: Australia's priorities: executive summary. Australian and New Zealand Environment Conservation Council. http://www.deh.gov.au/biodiversity/publications/research-priorities/summary.htm, Accessed 12 March 2007

Aretino B, Holland P, Peterson D, Schuele M (2001) Creating Markets for Biodiversity: A Case Study of Earth Sanctuaries Ltd, Productivity Commission Staff Research Paper, AusInfo, Canberra

Bacchi C (2003) What works, what doesn't: landowner reaction panel, p 119 In: De Cuir N, Sokolow AD, Woled J (eds) Compensating landowners for conserving agricultural land. Papers from a California

Conference. Community Studies Extension Department of Human and Community Development. University of California, Davis

Banks G (2003) The good, the bad and the ugly: economic perspectives on regulation in Australia. Address to the Conference of Economists, Business Symposium, Hyatt Hotel, Canberra, 2 October (2003). Productivity Commission, Melbourne

Bates G (2001) A duty of care for the protection of biodiversity on land, Consultancy Report, Report to the Productivity Commission, AusInfo, Canberra, 40 pp

Binning C, Young M (1997) Motivating people - using management agreement to conserve remnant vegetation. Report prepared for the National Research and Development Program on Rehabilitation, Management and Conservation of Remnant Vegetation, Report, 1/97, Land and Water Resources Research Development Corporation, Canberra

Binning C, Young M (1999) Beyond roads, rates and rubbish: opportunities for local government to conserve native vegetation. National R&D Program on Rehabilitation, Management and Conservation of Remnant Vegetation, Research Report, 1/99, Environment Australia, Canberra

Borthwick D (2005) Valuing our environment – using economics to strengthen protection. National Conservation Incentives Forum, 5–8 July 2005, La Trobe University, Melbourne, 8 pp

Bragg DC, Kirshner JL (1999) Coarse woody debris in riparian zones. J For 97(4):30–35

Carey AB (2003) Restoration of landscape function: reserves or active management? Forestry 76(2):221–230

Chaudhri V (2003) Market-like policy options. Department of Sustainability and Environment, Melbourne, Victoria, p 20

Clarkson J (2000) Threatened plant conservation in cape york forges ahead. *Danthonia* 9(1). http://www.anbg.gov.au/anpc/danv9n1.html, Accessed 12 March 2007

Deane P, Schirmer J, Bauhus J (2003) How private landholders use and value the native forest that they own: a report based on a sample survey conducted in south-east New South Wales. School or Resources Environment and Society, ANU, Canberra, 103 pp

DNR (2006) Draft code of practice for private native Forestry. Department of Natural Resources, Sydney, NSW 31 pp. http://www.dnr.nsw.gov.au/vegetation/pdf/pnf_code_practice.pdf, Accessed 12 March 2007

Dyer MI, Holland MM (1991) The biosphere-reserve concept: needs for a network design. BioScience 41(5):319–325

Emerton L (1999) Community-based incentives for nature conservation, IUCN, Gland

Ferraro PJ (2001) Global habitat protection: limitations of development interventions and a role for conservation performance payments. Conserv Biol 15(4):990–1000

Ferraro T, Burnside D (2001) WEST 2000: a case study of natural resource management investment in the NSW rangelands. Proceedings of the Australian Association of Natural Resource Management Inc. Dubbo, 23 November 2001. http://www.regional.org.au/au/aanrm/2001/ferraro.htm, Accessed 12 March 2007

Ferraro PJ, Simpson RD (2002) The cost-effectiveness of conservation payments. Land Econ 78(3):339–353

Fisher DO, Blomberg SP, Owens IPF (2003) Extrinsic versus intrinsic factors in the decline and extinction of Australian marsupials. Proc R Soc Lond B 270:1801–1808

Garnett ST, Crowley GM (2000) The action plan for Australian birds 2000. Environment Australia, Canberra. http://www.deh.gov.au/biodiversity/threatened/action/birds2000/threats.html, Accessed 12 March 2007

Goldstein JH, Daily GC, Friday JB, Matson PA, Naylor RL, Vitousek P (2006) Business strategies for conservation on private lands: Koa forestry as a case study. Proc Natl Acad Sci USA 103:10140–10145

Hahn RW, Stavins RN (1992) Economic incentives for environmental protection: integrating theory and practice. Am Econ Rev 82(2):464–468

Hone P, Fraser I (2004) Resource management and duty of care. Agenda 11(3):195–209

Hutton JM, Leader-Williams N (2003) Sustainable use and incentive-driven conservation: realigning human and conservation interests. Oryx 37:215–226

Jasper R (2004) Flood as an agent of renewal: lessons for revegetation. Ecol Manage Restor 5:210–211

Khanna M (2001) Nonmandatory Approaches to environmental protection. J Econ Surv 15(3):291–324

Kingsford RT (2000) Ecological impacts of dams, water diversions and river management on floodplain wetlands in Australia. Austral Ecol 25(2):109–127

Kleijn D, Sutherland WJ (2003) How effective are European agri-environment schemes in conserving and promoting biodiversity? J Appl Ecol 40(6):947–969

Kluender RA, Walkingsticks TL, Pickett JC (1999) The use of forestry incentives by nonindustrial forest landowner groups: is it time for a reassessment of where we spend our tax dollars? Natural Resour 39:799–818

Lindenmayer DB, Burgman MA (2005) Practical conservation biology. CSIRO Publishing, Melbourne

Lockwood M, Walpole S, Miles C (2000) Economics of remnant native vegetation conservation on private property. National Research and Development Program on Rehabilitation, Management and Conservation of Remnant Vegetation, Research Report 2/00. Land and Water Resources Research and Development Corporation, Canberra

Lunney D (2001) Causes of the extinction of native mammals of the Western Division of New South Wales: an ecological interpretation of the nineteenth century historical record. Rangeland J 23(1):44–70

Matysek KA, Stratford E, Kriwoken LK (2006) The UNESCO biosphere reserve program in Australia: constraints and opportunities for localized sustainable development Can Geogr 50(1):85–100

McNeely JA (1994) Lessons from the past: forests and biodiversity. Biodiv Conserv 3:3–20

McNeely JA (2006) A new approach to Incentives under the convention on biological diversity. Eighth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP8) Curitiba, Brazil, 20–31 March 2006

Mech T, Lowe K, Cole A (2003) Land stewardship and environmental management systems. Department of Sustainability and Environment, Melbourne

Moore SA, Renton S (2002) Remnant vegetation, landholders' values and information needs: an exploratory study in the West Australian wheatbelt. Ecol Manage Restor 3(3):179–187

Nichols JD (2007) Evolution and development of a code for private native Forestry in New South Wales, Australia. Small-Scale Forestry, 6(2), in press

NSW (1995) Threatened Species Conservation Act 1995, reprint no. 5, 6 December 2005. http://www.austlii.edu.au/au/legis/nsw/consol_act/tsca1995323, Accessed 12 March 2007

NSW (2003) Native Vegetation Act 2003 No 103. New South Wales Government. http://www.nswfarmers.org.au/__data/page/6608/NativeAct2003No103_dec03.pdf, Accessed 12 March 2007

NVRIG (Native Vegetation Reform Implementation Group) (2003) Final report, Department of Infrastructure, Planning and Natural Resources, Sydney

OSR (2006) Annual Report 2005–2006. Office of State Revenue, New South Wales Treasury, Sydney

Pagiola S, Bishop J, Landell-Mills N (2002) Selling Forest environmental services: market-based mechanisms for conservation and development. Earthscan, London

Pannell DJ (2007) Public benefits, private benefits, and the choice of policy tool for land use change. http://cyllene.uwa.edu.au/~dpannell/dp0601.htm, Accessed 23 March 2007

Productivity Commission (2001) Harnessing private sector conservation of biodiversity, Commission Research Paper, Ausinfo, Canberra

Productivity Commission (2004) Impacts of native vegetation and biodiversity regulations, Report no. 29, Melbourne

Robinson J, Ryan S (2002) A review of economic instruments for environmental management in Queensland. CRC for Coastal Zone, Estuary and Waterway Management, Brisbane

Saunders DA, Hobbs RJ, Margules CR (1991) Biological consequences of ecosystem fragmentation: a review. Conserv Biol 5(1):18–32

Schaaf KA, Broussard SR (2006) Private forest policy tools: a national survey exploring the American public's perceptions and support. Forest Policy Econ 9(4):316–334

Sheail J, Treweek JR, Montford JO (1997) The UK transition from nature preservation to 'creative conservation'. Environ Conserv 24:224–235

Shogren JF (ed) (2005) Species at risk: using economic incentives to shelter endangered species on private lands. University of Texas Press, Austin

Sinden, JA (2003) Who pays to protect native vegetation? Costs to farmers in Moree Plains Shire, New South Wales. Working Paper Series in Agricultural and Resource Economics No. 2003–2

Smith TB, Bruford MW, Wayne RK (1993) The preservation of process: The missing element of conservation programs. Biodiv Lett 1:164–167

Stephens S (2001) Visions and viability: how achievable is landscape conservation in Australia? Ecol Manage Restor 2:189–195

Stoneham G (2003) An overview of the ideas and information needed to develop and implement MBIs. Paper presented to the 6th Annual AARES National Symposium 2003: Market-Based Tools for Environmental Management, Canberra ACT, September 2003

Stoneham G, Crowe M, Platt S, Chaudhri V, Soligo J, Strappazzon L (2000) Mechanisms for biodiversity conservation on private land. Department of Natural Resources and Environment, East Melbourne

Vanclay JK (2007) Community attitudes towards Private Native Forestry in New South Wales. Small-Scale Forestry 6(2), DOI: 10.1007/s11842-007-9009-z

Vanclay JK, Thompson D, Sayer J, McNeely J, Kaimowitz D, Gibbs A, Crompton H, Cameron, D, Bevege I (2006) A proposal for stewardship support to private native forests in NSW. Southern Cross Group, ISBN 097759761X. http://www.privateforestry.org.au/SCG.pdf, Accessed 12 March 2007

Whitten S, Salzman J, Shelton D, Proctor W (2003) Markets for ecosystem services: applying the concepts. Paper presented at the 47th Annual Conference of the Australian Agricultural and Resource Economics Society, Fremantle

Wittenberg R; Cock MJW (2001) Invasive alien species. How to address one of the greatest threats to biodiversity: a toolkit of best prevention and management practices. CAB International, Wallingford

Wu J, Babcock BA (1999) The relative efficiency of voluntary vs mandatory environmental regulations. J Environ Econ Manage 38(2):158–175

Wunder S (2005) Payments for environmental services: some nuts and bolts. CIFOR Occasional Paper No 42, 32 pp

Zhang D, Flick WA (2001) Sticks, carrots, and reforestation investment. Land Econ 77(3):443–456